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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/609,096	06/27/2003	Matthias Kuhn	2000.105900	9223

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EXAMINER	
NGUYEN, GEORGE BINH MINH	
ART UNIT	**PAPER NUMBER**
3723	

DATE MAILED: 09/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/609,096	KUHN ET AL.	
	Examiner	Art Unit	
	George Nguyen	3723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 August 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-43* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 June 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *111703*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Receipt is acknowledged of Applicant's election with traverse of Species I of Figures 2A and 2B.

After the exhaustive search was conducted in combination with Applicant's persuasive argument, the examiner withdrawer the restriction.

Claims 1-43 are presented for examination.

This application has been filed with formal drawings which are accepted to the examiner.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-3, 5-7, 9-11, 13-14, 15-17, 19-27, 28, 30-32, 34-35, 37-43 are rejected under 35 U.S.C. 102(b) as being anticipated by Kimura et al.'5,716,264.

With reference to Figures 3, 6a-b, col. 5, lines 48 to col. 7, line 33, Kimura discloses the claimed invention.

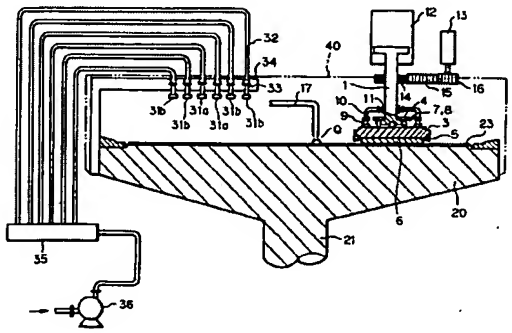


Fig. 6a

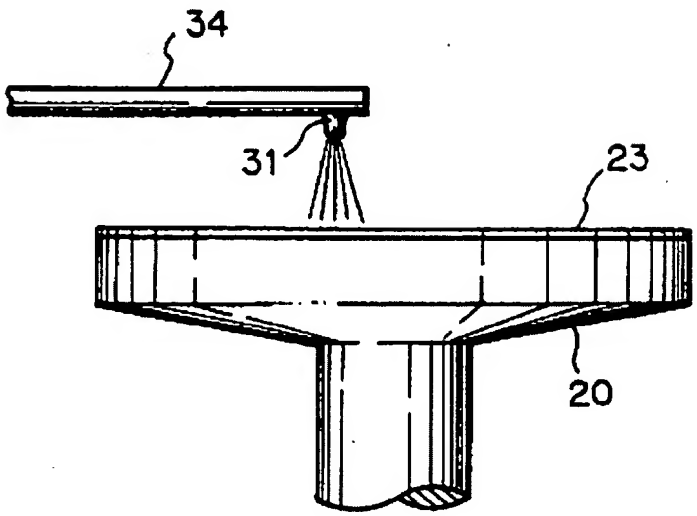
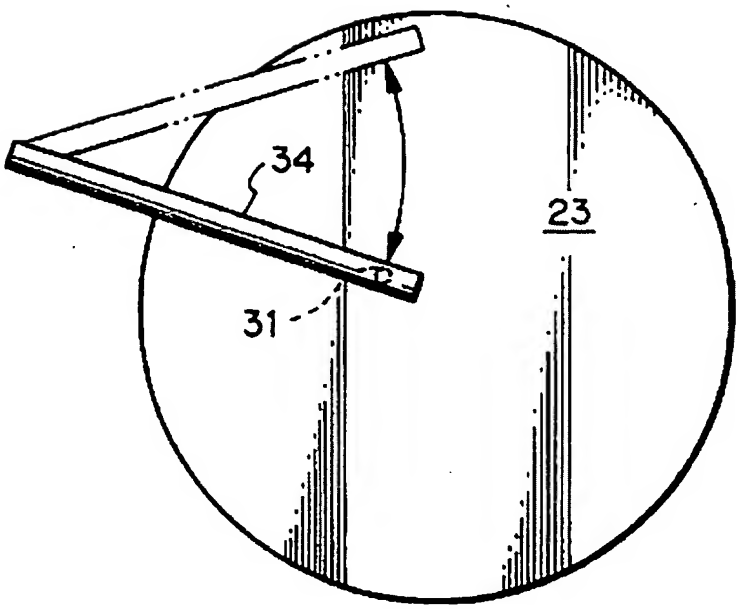


Fig. 6b



gears 14, 15 and 16. The polishing/abrasive liquid spray nozzle 17 is arranged above the turntable 20, and is adapted to spray a polishing/abrasive liquid Q over the polishing cloth 23 of the turntable 20.

Next, the manner of polishing the wafer by means of the polishing apparatus of the above-described construction will be described.

Description will be made in such a case wherein the semiconductor is an object to be polished.

The semiconductor wafer 6 is applied by vacuum against the lower surface of the top ring body lower portion 3-2. To allow the semiconductor 6 to be sucked against the lower surface of the top ring body lower portion 3-2, air is withdrawn through vacuum-section ports 3-2*a* defined in the top ring body lower portion 3-2 and vacuum port 1*b* defined in the central portion of the top ring driving shaft 1 by a vacuum source. The semi-conductor wafer is applied by vacuum pressure against the lower surface of the top ring 3, from a delivery portion (not shown) which is arranged adjacent to the turntable 20.

Then, after the top ring 3 upon which the semi-conductor 6 is retained is shifted onto the turntable 20, the top ring 3 is lowered to place the semiconductor wafer 6 upon the polishing cloth 23 on the upper surface of the turntable 20. Then, atmospheric air is passed into the vacuum suction ports 3-2*a* by disconnecting the vacuum port 1*b* from the vacuum pressure source. Consequently, the semiconductor 6 is released from the lower surface of the top ring 3, and the semiconductor 6 is adapted to rotate against the lower surface of the top ring 3. By rotating the turntable 20 and the top ring 3, and actuating the top ring cylinder 12 to push the top ring 3 toward the turntable 20, the semiconductor 6 is urged against the polishing cloth 23 mounted upon the upper surface of the turntable 20. A polishing/abrasive liquid Q is caused to flow onto the polishing cloth 23 from the polishing/abrasive liquid spray nozzle 17, and the polishing/abrasive liquid Q is retained in the polishing cloth. Consequently, the polishing/abrasive solution Q reaches the surface (lower surface) of the semiconductor wafer to be polished, and thus the polishing operation may be initiated.

After the polishing operation is completed, the semiconductor wafer 6 is again drawn by vacuum against the lower surface of the top ring 3, and the top ring 3 is caused to shift from the turntable 30 to deliver the semiconductor wafer 6 into a cleaning station and the like.

A mechanism for carrying out a dressing operation will be described. In the apparatus as shown in FIG. 3, water jets are sprayed against the surface of the polishing cloth 23 through nozzles 31*a* and 31*b* which are fixed in position on nozzle support member 34 by means of nozzle fixture 33. A plurality of each of nozzles 31*a* and 31*b* are arranged in spaced positions in a dimensional direction of the polishing cloth 23. Flow velocity, flow rate, angle of spray, and cross-sectional configuration of the nozzles 31*a* and 31*b* vary from each other. Water is pressurized by a pump 36 and is then delivered to tubes 32 corresponding to respective nozzles via a branch pipe 35. Water is then supplied to respective nozzles 31*a* and 31*b* through tubes 32 to be sprayed as jets from the nozzles. The nozzles are arranged and oriented such that water which is sprayed from the nozzles strikes the area on the polishing cloth 23 where polishing is to be carried out, i.e., against which a wafer 6 is urged and polished.

A collision pressure which is generated when a water jet strikes the cloth surface is used as a water impact pressure, and the volume of the water provided is in proportion to its density, flow velocity, spray stream and sonic velocity. Such water impact pressure serves to loosen abrasive grains which have accumulated in the cloth, and such grains are then be discharged together with the water.

A cover 40 may be provided to prevent water from splashing circumferentially as shown by phantom lines in FIG. 3.

FIG. 4 is a view illustrating a difference in the angle of water spray, i.e. a diffusion angle, between nozzles 31*a* and 31*b*. Further, FIG. 5 is a plan view illustrating the area on the polishing cloth where polishing is carried out, in conjunction with the nozzle position. FIG. 5 shows only components necessary for illustration of the invention, omitting those members which are not necessary for explanation. In FIG. 5, the shaded area 37 indicates the area on the polishing cloth where polishing is carried out, and a dotted line 38 indicates a center of the area 37 where polishing is carried out.

The nozzle 31*a* is arranged to spray a water jet against an area close to the center 38 of the area where polishing is carried out, whereas the nozzle 31*b* is arranged to spray a water jet against an area more remote from the center 38 of the area where polishing is carried out. As shown in FIG. 4, the angle of water spray from the nozzle 31*a* is made to be smaller than that of a water jet to be sprayed from the nozzle 31*b*. This difference in the angle of water spray serves to make the water impact pressure from the nozzle 31*a* (magnitude of total water impact pressure per unit area and unit time) to be greater than that sprayed from the nozzle 31*b*. Consequently, the water jet having a greater impact pressure strikes a portion closer to the center 38 in the area in the polishing cloth 23 where polishing is carried out, whereas a relatively reduced water jet strikes a portion remote from the center 38. As a result, the impact jet pressure which strikes a portion closer to the center 38 is made greater than that of a jet which strikes the portion remote from the center 38.

As a polishing operation proceeds, abrasive grains accumulate in the polishing cloth, at an area closer to the center 38 of the area where polishing is carried out, with the volume of grains decreasing relatively as the distance from the center 38 increases. By using nozzles having a varied spray angle in combination as a means for carrying out a dressing operation, it is possible to apply a water jet of greater impact pressure on an area closer to the center of an area where polishing is carried out, with a water jet of reduced impact pressure being applied on an area remote from the center 38 of the area where polishing is carried out. Thus, abrasive grains which have been degraded may be discharged in a more efficient manner, thereby causing the volume of abrasive grains to be distributed evenly in the polishing cloth 23 after a dressing operation is complete.

In relation to the above-described embodiment, microscopic observation of a cloth surface which has been dressed indicates that degraded abrasive grains are discharged in an improved manner. Furthermore, subsequent polishing is more effective than when a conventional method is employed.

In the above-described embodiment, a nozzle array is formed in which a nozzle having a reduced spray angle is provided as a nozzle closer to the center, and a nozzle having a greater spray angle is provided as the nozzle proximate to the end. However, the nozzle proximate to the center may be provided with an increased spray angle, if various polishing conditions are employed. There may be some instances where an impact pressure distribution may be required to be varied from that employed in this embodiment. However,

such variance falls within the scope of the present invention, whereby an impact pressure may be distributed in a manner different from that described above.

In the embodiment shown herein, an impact pressure distribution is realized by varying the nozzle configuration for a plurality of nozzles, but alternative approaches may be utilized to provide similar effects. A plurality of tubes arranged for supplying water to nozzles may be provided with respective valves, and a water jet may be controlled by manipulating the valves. A pressure source such as a pump, etc., may be provided for respective nozzles to thereby vary water jets. Such arrangements also fall within the scope of the present invention.

Other embodiments will be described with reference to FIGS. 6*a* and 6*b*. FIG. 6*a* is an elevation view showing the turntable and the fluid jet nozzle for the dressing operation in the polishing apparatus according to the present invention. In this embodiment, a single nozzle 31 is provided, but the fluid jet may cover the entire area of the polishing cloth 23, because the nozzle supporting member 34 travels over the polishing cloth 23 in an oscillating manner during a dressing operation, as shown by an arrow in FIG. 6*b*. Besides, even though only a single fluid jet is provided, it is possible to vary time expended on dressing to influence respective portions of the polishing cloth 23, thereby ensuring an effect similar to that provided in such a case where a plurality of nozzles is employed, as described above, by suitably determining a pattern of travel of the nozzle supporting member 34, and the rotation speed of the turntable.

In the above-described embodiment, although a water jet is used, the present invention may also be applied to a dressing operation in which a liquid other than water and a gas are used as a jet to dress the object.

In the above-described embodiment, although polishing apparatus and method for polishing a semiconductor wafer into a flat and mirror-like configuration are described, the object to be polished is not limited to a semiconductor wafer.

Moreover, in the above-described embodiment, although the present invention has been described with reference to an embodiment in which a single semiconductor wafer is polished with a single top ring, it is also possible to provide an alternative embodiment in which a template-like top ring is formed with a plurality of water ports so that a plurality of wafers may be polished in a similar manner.

The present invention is also applicable to a case in which a fluid jet is used to dress a polishing cloth for use in a polishing apparatus whereby an object is polished by means of a roller around which a polishing cloth is wound.

(Effect of the Invention)

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 4, 8, 12, 18, 27, 29, 33, 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al.'264 in view of Butterfield et al.'6,764,389, and Tanaka'5.902,173.

Regarding to claims 4 and 29, Kimura has been discussed above, but does not disclose the limitations set forth in the claims. Butterfield et al.'389 discloses a conditioning arm having a first dimension smaller than a second dimension. The advantage is to cover a wider conditioning area on a polishing pad.

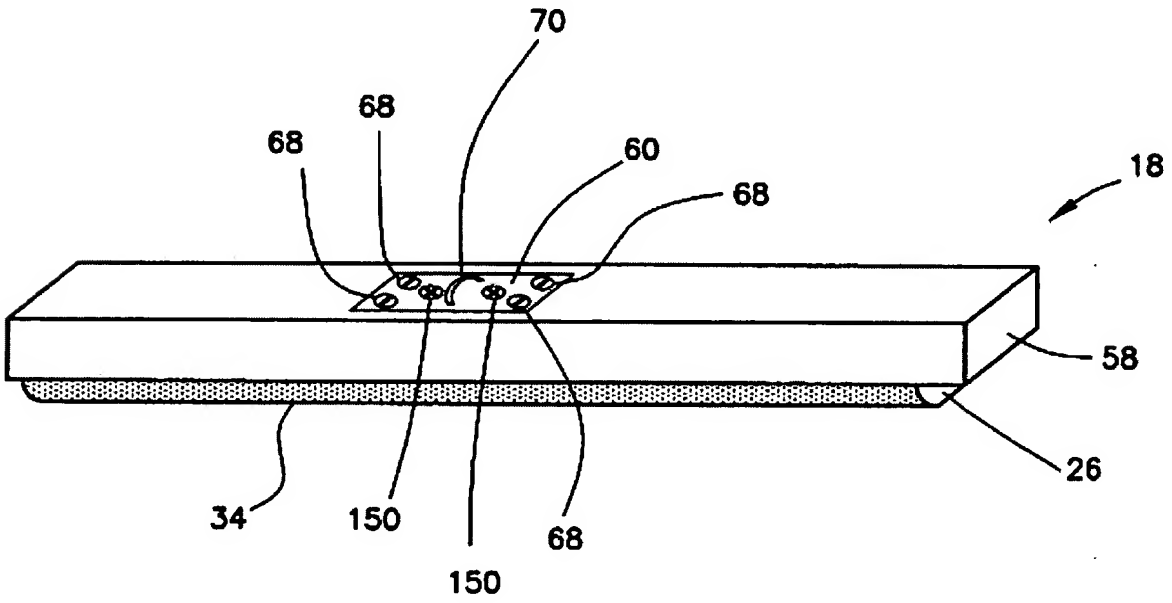


FIG. 4

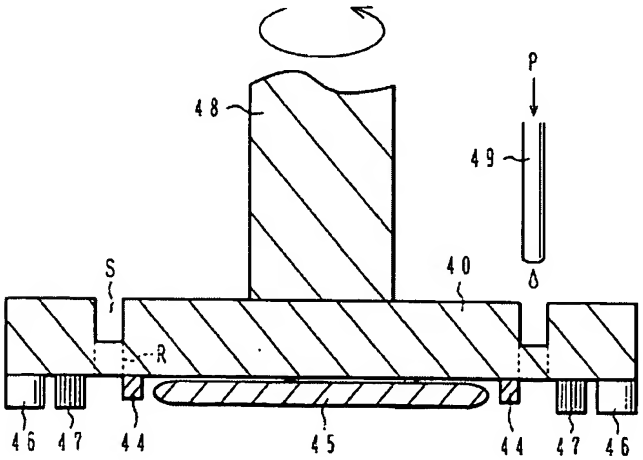
Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified with conditioning tool of Kimura with a rectangular

shaped conditioning tool as taught by Butterfield in order to cover wider conditioning area on a polishing pad to achieve a more effective conditioning operation.

Regarding to claims 8 and 33, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized an abrasive slurry to condition a polishing pad since abrasive slurry has been a well-known conditioning medium because it effectively remove embedded material in the polishing pad.

Regarding to claims 12 and 35, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilized a bi-directional linear motion conditioning tool to condition a polishing pad since a bi-directional linear motion conditioning tool has been a well-known conditioning tool because it effectively covers a wider conditioning area to achieve a more effective conditioning operation.

Regarding to claim 18, Kimura has been discussed above, but does not disclose a conditioner attached to the wafer carrier as set forth in claim. With reference to figure 22, Tanaka discloses that it is known to attach a pad conditioner to a polishing head so that in this manner while polishing is performed, dressing is performed at the same time.



Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the conditioner tool of Kimura with the teaching of Tanaka in order to simultaneously perform the polishing and the dressing to achieve an optimum polishing operation.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. So'968 and Moore'332 all discloses linearly operated conditioning tool. Allman et al.'502 discloses a conditioning tool with a slurry.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to George Nguyen whose telephone number is 703-308-0163. The examiner can normally be reached on Monday-Friday/630AM-300PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Hail can be reached on 703-308-2687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

George Nguyen

Primary Examiner
Art Unit 3723

GN – September 12, 2004

GEORGE NGUYEN
PRIMARY EXAMINER